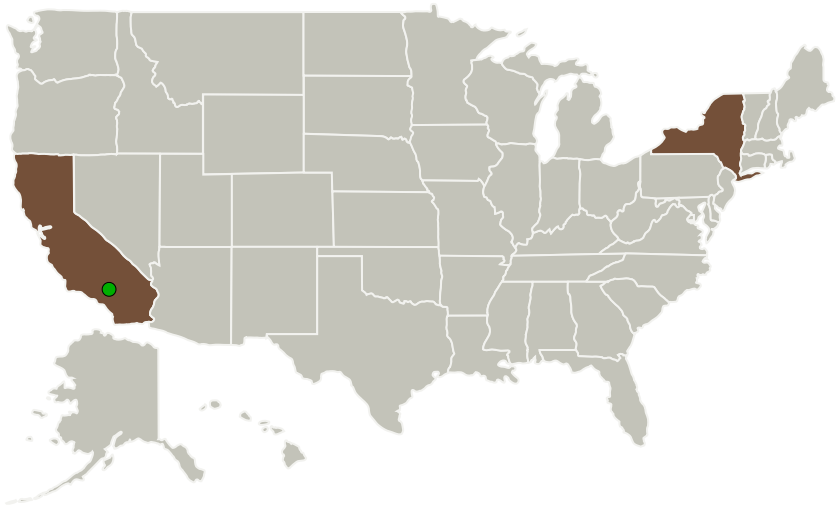
Physics-based Models for Aeroservoelasticity Prediction and Control, Phase I

Completed Technology Project (2016 - 2016)

Project Introduction

Clear Science Corp. proposes to develop and demonstrate computational fluid dynamics (CFD)-based, reduced-order aeroservoelasticity modeling and simulation technology for fast and accurate predictions of nonlinear flight dynamics, enabling real-time, piloted and unpiloted flight simulations and providing a tool to design flight controllers for highly flexible, lightweight aircraft. Physics-based, reduced-order models (ROMs) will be developed and demonstrated with data from CFD models of the X-56, an experimental aircraft that NASA and the U. S. Air Force are using to test systems for flutter suppression and gust-load alleviation. Extended range and low fuel consumption through lightweight materials and large wing spans (high lift-to-drag ratios) are the drivers in next-generation aircraft like the X-56, but these attributes create challenges in maintaining flight safety, ride quality, and long-term structural durability. The development of flight controllers that can actively manage aeroservoelastic effects (body-freedom flutter, control reversal, gust loading) without compromising safety and aerodynamic performance is a key objective of both the X-56 Program and the proposed project. Through the proposed technology, nonlinear, aeroservoelastic ROMs can be coupled to other components of a flight simulator (six-degrees-of-freedom flight mechanics models and control software) to improve the fidelity of simulations that support controller design for a wide range of operating conditions.

Primary U.S. Work Locations and Key Partners



Physics-based Models for Aeroservoelasticity Prediction and Control, Phase I

Table of Contents

Physics-based Models for Aeroservoelasticity Prediction and Control, Phase I

Completed Technology Project (2016 - 2016)

Organizations Performing Work	Role	Type	Location
Clear Science Corporation	Lead Organization	Industry	Harford, New York
Armstrong Flight Research Center(AFRC)	Supporting Organization	NASA Center	Edwards, California

Primary U.S. Work Locations	
California	New York

Project Transitions

June 2016: Project Start

December 2016: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139669)*

Images

Briefing Chart Image
Physics-based Models for Aeroservoelasticity Prediction and Control, Phase I
(https://techport.nasa.gov/image/127241)

Final Summary Chart Image
Physics-based Models for Aeroservoelasticity Prediction and Control, Phase I Project Image
(https://techport.nasa.gov/image/134653)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Clear Science Corporation

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

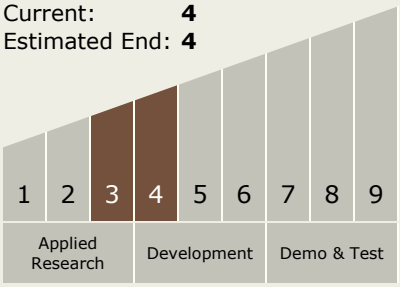
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Henry A Carlson

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Physics-based Models for Aeroservoelasticity Prediction and Control, Phase I

Completed Technology Project (2016 - 2016)

Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  - TX11.1 Software Development, Engineering, and Integrity
    - TX11.1.7 Frameworks, Languages, Tools, and Standards

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System